IN THE CLAIMS

1. (currently amended) A rotational-operation-quantity input device for inputting an operation quantity indicating a predetermined rotation angle, comprising:

a two-dimensional force sensor for inputting an operational force applied by an operator in time series as ~~a~~ coordinate values (x, y) in an XY two-dimensional rectangular coordinate system;

a polar-coordinate converting section for sequentially converting the coordinate values (x, y) in the rectangular coordinate system given in time series into ~~a~~ polar coordinate values (r, θ) in a polar coordinate system; and

an operation-quantity recognizing section for recognizing a variation in a value θ of the polar coordinate values (r, θ) obtained in time series as an operation quantity indicating a rotation angle;

wherein said two-dimensional force sensor includes

a substrate having an upper surface on which said XY two-dimensional rectangular coordinate system with an X-axis and a Y-axis intersecting on said upper surface is defined,

a group of detection electrodes fixed on said upper surface,

a pair of outer electrodes fixed on said upper surface and disposed on an area outside of an area on which said detection electrodes are fixed,

an elastic deformable body disposed on said substrate so as to cover said detection electrodes and said pair of outer electrodes,

displacement conductive layers formed on a lower surface of said elastic deformable body so as to oppose said detection electrodes and said pair of outer electrodes, a group of capacitance elements being formed between said detection electrodes and respective opposing displacement conductive layers,

an operating panel disposed on an upper surface of said elastic deformable body, said operating panel can be inclined by said operational force so as to change capacitance values of said capacitance elements, and

a detection circuit for detecting said coordinate values (x, y) based on capacitance values of said detection capacitance elements as long as a displacement conductive layer is in contact with both of said pair of outer electrodes.

2. (currently amended) The rotational-operation-quantity input device as set forth in Claim 1, wherein the operation-quantity recognizing section recognizes the polar coordinate values (r, θ) as a significant coordinate value when value r of the polar coordinate value (r, θ) is larger than a predetermined threshold rt, and recognizes an operation quantity based on a variation in a value θ in consideration of only a significant coordinate value (r, θ).

3. (original) The rotational-operation-quantity input device as set forth in Claim 2, wherein the operation-quantity recognizing section recognizes an operation quantity based on a variation in value θ during a continuous period when a significant coordinate value (r, θ) is obtained continuously.

4. (currently amended) The rotational-operation-quantity input device as set forth in Claim 3, wherein, when a value θ generates a variation Δθ exceeding a predetermined threshold θt with respect to a value "θ before" immediately ~~there~~ before ~~during~~ a ~~continuous~~ period during which a significant coordinate value (r, θ) is obtained continuously, the operation-quantity recognizing section recognizes a value corresponding to the variation Δθ as an operation quantity.

5. (canceled)

6. (previously presented) An operating device including the input device as set forth in Claim 1, having an operational function to specify an icon, comprising:

icon display means for annularly displaying a plurality of icons on a display screen;

distinguishing means for displaying an indicator to distinguish a specified icon on the display screen by receiving an instruction to specify one of the plurality of icons;

initial-icon specifying means for specifying any one of the plurality of icons as a first specified icon; and

specified-icon changing means for giving an instruction to change the specified icon into a new icon disposed at a position having an interval corresponding to an operation quantity recognized by the operation-quantity recognizing section of the input device.

7. (previously presented) An operating device including the input device as set forth in Claim 1, being used for volume control or for forwarding/rewinding control in reproducing sound, comprising:

rotation knob display means for displaying a rotation knob used to perform a volume control operation or a forwarding/rewinding control operation in reproducing sound on the display screen; and

control means for determining a rotation quantity of the rotation knob correspondingly with an operation quantity recognized by the operation-quantity recognizing section of the input device and causing the rotation knob display means to perform a display corresponding to the rotation quantity while performing volume control or forwarding/rewinding control correspondingly with the rotation quantity.

8. (previously presented) An operating device including the input device as set forth in Claim 1, being used for frame feed in reproducing moving image, comprising:

rotation knob display means for displaying a rotation knob used to perform a frame feed operation in reproducing moving image on the display screen; and

control means for determining a number of frames to be fed correspondingly with an operation quantity recognized by the operation-quantity recognizing section of the input device and causing the rotation knob display means to perform a display indicating a rotational operation corresponding to the number of frames.

9. (new) The rotational operation quantity input device as set forth in Claim 1, wherein displacement conductive layers opposing the detection electrodes and the pair of outer electrodes are made of a physically integrated single layer.

10. (new) A rotational-operation-quantity input device for inputting an operation quantity indicating a predetermined rotation angle, comprising:

a two-dimensional force sensor for inputting an operational force applied by an operator in time series as coordinate values (x, y) in an XY two-dimensional rectangular coordinate system;

a polar-coordinate converting section for sequentially converting the coordinate values (x, y) in the rectangular coordinate system given in time series into polar coordinate values (r, θ) in a polar coordinate system; and

an operation-quantity recognizing section for recognizing a variation in a value θ of the polar coordinate values (r, θ) obtained in time series as an operation quantity indicating a rotation angle;

wherein said two-dimensional force sensor includes

a substrate having an upper surface on which said XY two-dimensional rectangular coordinate system with an X-axis and a Y-axis intersecting on said upper surface is defined,

a first electrode, a second electrode, a third electrode and a fourth electrode fixed on said upper surface, said first electrode being disposed on a positive area of said X-axis, said second electrode being disposed on a negative area of said X-axis, said third electrode being disposed on a positive area of said Y axis and said fourth electrode being disposed on a negative area of said Y axis,

a pair of outer electrodes fixed on said upper surface and disposed around said first to fourth electrodes,

an elastic deformable body disposed on said substrate so as to cover said first to fourth electrodes and said pair of outer electrodes,

a displacement conductive layer formed on a lower surface of said elastic deformable body so as to oppose said first to fourth electrodes and said pair of outer electrodes, a first capacitance element being formed between said first electrode and an opposing part of said displacement conductive layer, a second capacitance element being formed between said second electrode and an opposing part of said displacement conductive layer, a third capacitance element being formed between said third electrode and an opposing part of said displacement conductive layer and a fourth capacitance element being formed between said fourth electrode and an opposing part of said displacement conductive layer,

an operating panel disposed on an upper surface of said elastic deformable body, said operating panel can be inclined by said operational force in said X axis direction and said Y axis direction with respect to said substrate, wherein an inclination in said X axis direction of said operating panel changes capacitance values of said first capacitance element and said second capacitance element and an inclination in said Y axis direction of said operating panel changes capacitance values of said third capacitance element and said fourth capacitance element, and

a detection circuit for detecting a coordinate value x based on capacitance values of said first capacitance element and said second capacitance element and a coordinate valve y based on capacitance values of said third capacitance element and said fourth capacitance element as long as said displacement conductive layer is in contact with both of said pair of outer electrodes.

11. (new) The rotational-operation-quantity input device as set forth in Claim 9, wherein the operation-quantity recognizing section recognizes the polar coordinate values (r, θ) as a significant coordinate value (r, θ) when value r of the polar coordinate values (r, θ) is larger than a predetermined threshold rt, and recognizes an operation quantity based on a variation in a value θ in consideration of only the significant coordinate value (r, θ).

12. (new) The rotational-operation-quantity input device as set forth in Claim 11, wherein the operation-quantity recognizing section recognizes an operation quantity based on a variation in value θ during a continuous period when a significant coordinate value (r, θ) is obtained continuously.

13. (new) The rotational-operation-quantity input device as set forth in Claim 12, wherein, when a value θ generates a variation Δθ exceeding a predetermined threshold θt with respect to a value "θ before" immediately before a period during which a significant coordinate value (r, θ) is obtained continuously, the operation-quantity recognizing section recognizes a value corresponding to the variation Δθ as an operation quantity.

14. (new) The rotational-operation-quantity input device as set forth in Claim 10, wherein the operation-quantity recognizing section recognizes the polar coordinate values (r, θ) as a significant coordinate value when value r of the polar coordinate values (r, θ) is larger than a predetermined threshold rt, and recognizes an operation quantity based on a variation in a value θ in consideration of only a significant coordinate value (r, θ).

15. (new) The rotational-operation-quantity input device as set forth in Claim 14, wherein the operation-quantity recognizing section recognizes an operation quantity based on a variation in value θ during a continuous period when a significant coordinate value (r, θ) is obtained continuously.

16. (new) The rotational-operation-quantity input device as set forth in Claim 15, wherein, when a value θ generates a variation Δθ exceeding a predetermined threshold θt with respect to a value "θ before" immediately before a period during which a significant coordinate value (r, θ) is obtained continuously, the operation-quantity recognizing section recognizes a value corresponding to the variation Δθ as an operation quantity.

17. (new) An operating device including the input device as set forth in Claim 9, having an operational function to specify an icon, comprising:

icon display means for annularly displaying a plurality of icons on a display screen;

distinguishing means for displaying an indicator to distinguish a specified icon on the display screen by receiving an instruction to specify one of the plurality of icons;

initial-icon specifying means for specifying any one of the plurality of icons as a first specified icon; and

specified-icon changing means for giving an instruction to change the specified icon into a new icon disposed at a position having an interval corresponding to an operation quantity recognized by the operation-quantity recognizing section of the input device.

18. (new) An operating device including the input device as set forth in Claim 10, having an operational function to specify an icon, comprising:

icon display means for annularly displaying a plurality of icons on a display screen;

distinguishing means for displaying an indicator to distinguish a specified icon on the display screen by receiving an instruction to specify one of the plurality of icons;

initial-icon specifying means for specifying any one of the plurality of icons as a first specified icon; and

specified-icon changing means for giving an instruction to change the specified icon into a new icon disposed at a position having an interval corresponding to an operation quantity recognized by the operation-quantity recognizing section of the input device.

19. (new) An operating device including the input device as set forth in Claim 9, being used for volume control or for forwarding/rewinding control in reproducing sound, comprising:

rotation knob display means for displaying a rotation knob used to perform a volume control operation or a forwarding/rewinding control operation in reproducing sound on the display screen; and

control means for determining a rotation quantity of the rotation knob correspondingly with an operation quantity recognized by the operation-quantity recognizing section of the input device and causing the rotation knob display means to perform a display corresponding to the rotation quantity while performing volume control or forwarding/rewinding control correspondingly with the rotation quantity.

20. (new) An operating device including the input device as set forth in Claim 10, being used for volume control or for forwarding/rewinding control in reproducing sound, comprising:

rotation knob display means for displaying a rotation knob used to perform a volume control operation or a forwarding/rewinding control operation in reproducing sound on the display screen; and

control means for determining a rotation quantity of the rotation knob correspondingly with an operation quantity recognized by the operation-quantity recognizing section of the input device and causing the rotation knob display means to perform a display corresponding to the rotation quantity while performing volume control or forwarding/rewinding control correspondingly with the rotation quantity.

21. (new) An operating device including the input device as set forth in Claim 9, being used for frame feed in reproducing moving image, comprising:

rotation knob display means for displaying a rotation knob used to perform a frame feed operation in reproducing moving image on the display screen; and

control means for determining a number of frames to be fed correspondingly with an operation quantity recognized by the operation-quantity recognizing section of the input device and causing the rotation knob display means to perform a display indicating a rotational operation corresponding to the number of frames.

22. (new) An operating device including the input device as set forth in Claim 10, being used for frame feed in reproducing moving image, comprising:

rotation knob display means for displaying a rotation knob used to perform a frame feed operation in reproducing moving image on the display screen; and

control means for determining a number of frames to be fed correspondingly with an operation quantity recognized by the operation-quantity recognizing section of the input device and causing the rotation knob display means to perform a display indicating a rotational operation corresponding to the number of frames.